

**A Questionnaire Survey of Vancouver
Island Steelhead Anglers' Opinions
and
Preferences on Management Issues**

by

R. S. Hooton

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A QUESTIONNAIRE SURVEY OF
VANCOUVER ISLAND STEELHEAD ANGLERS' OPINIONS
AND PREFERENCES ON MANAGEMENT ISSUES

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R. S. Hooton¹

¹Ministry of Environment, 2569 Kenworth Road, Nanaimo, B.C.,
V9T 4P7

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ABSTRACT

Hooton, R. S. 1985. A Questionnaire Survey of Vancouver Island Steelhead Anglers' Opinions and Preferences on Management Issues in 1976/77. Fisheries Management Report No. 84, 30 p.

A questionnaire, which was mailed to a systematic sample of every second Vancouver Island steelhead trout angler, was used to evaluate their preferences for fishery management policies. The main objective was to assess angler attitudes toward augmenting steelhead production by stocking hatchery fish, and to develop recommendations for incorporation into a steelhead management plan for Vancouver Island.

A total of 1,693 completed forms out of 3068 (62%) were returned. Most Vancouver Island steelhead anglers had fished for five years or less, fished only during winter months, and failed to catch a steelhead. Years fished, days fished, and catch were highly variable and not correlated. A small proportion of anglers accounted for a large proportion of the steelhead catch. Lists of favorite streams, most fished streams, and streams most preferred for stocking were similar. Anglers belonging to a fishing club or society comprised 17% of the sample and some significant differences were apparent in the behavior, experiences, and management preferences of club versus non-club anglers. Sixty-one percent of all respondents favored production of steelhead from hatcheries for Vancouver Island in general and 85% favored hatchery production for the Campbell/Quinsam river system. The results emphasized the need for the Fisheries Branch to acquaint anglers with all aspects of the hatchery steelhead issue and to publicize the intent of catch and release regulations. Postal contact was the recommended option for reaching anglers. In view of the diversity of respondent experiences and preferences, it was recommended that management units contain fishing options roughly in proportion to user group preferences.

The potential bias associated with estimates of steelhead harvest based on a single mail out survey was also described; the need for accurate estimates identified; and an alternate approach involving follow-up contact and regression procedures suggested. Considering the highly unequal distribution of steelhead catch amongst anglers, it was recommended that experimental regulations limiting the number of steelhead an angler could release be instituted on at least one stream.

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INTRODUCTION

On Vancouver Island, steelhead catches have declined in most popular streams in recent years. Extensive logging, high exploitation by sport and commercial fisheries, water diversions and withdrawals, and industrial pollution are commonly cited causes. Fisheries managers contend that habitat degradation and losses have reduced the capacity of freshwater habitats to produce at historic levels and that some measure of artificial manipulation of production is required to maintain harvest rates and angling opportunity.

In 1976 the Salmonid Enhancement Program (SEP) was initiated by an agreement between Federal and Provincial governments. The major goal of S.E.P. is to double the mid-1970's commercial catch of salmon. Pursuit of this goal has resulted in the construction and planning of a number of hatcheries, many of which could incorporate steelhead rearing facilities, if desired. The question now facing fishery managers is the role of hatcheries relative to other steelhead management options. The primary objective of this study was to examine this question in detail and formulate management recommendations.

A systematic appraisal of client preferences was needed because of conflicting information on angler preferences for hatchery production of steelhead. Alker (1974) conducted a pilot study of organized and unorganized steelhead anglers in Region 2 and found that the two groups often preferred different management approaches. Also, public meetings in 1976 revealed that the more vocal public was opposed to a major emphasis on hatcheries to restore depleted anadromous fish stocks (Sinclair 1977). In contrast, Meyer (1976) and Pearse and Bowden (1971) produced evidence of strong public support for hatcheries.

Within the Fisheries Branch, the agency responsible for steelhead management, public input to decisions affecting fishery resources is a matter of growing concern. As demands on these resources intensify, the need for managers to become aware of client opinions and preferences increases (Withler 1972). Questionnaire studies have been used in a number of similar cases (Bjornn and Dalke 1975; Carpenter and Bowlus 1976; Duttweiler 1976; Hendee et al. 1968). The methodology has been sufficiently developed that, when properly employed, investigators may be confident of obtaining reliable results (Filion 1976).

This study represented the first step in formation of a regional steelhead management plan for Vancouver Island, and should be applicable to the Lower Mainland region. User preferences on important management issues were solicited to aid in implementation of selected management strategies. The study results were also intended to provide baseline data for use in future management decisions.

METHODS

SAMPLE AREA

Vancouver Island was one of eight resource management regions in British Columbia during 1976/77 (Fig. 1). In 1976, approx. 440,000 of the Province's 2.5 million inhabitants lived on Vancouver Island and, of these, half resided in or near the capital city, Victoria (Central Statistics Bureau 1980). At the time of this survey 6,136 Vancouver Island residents were licensed to fish for steelhead. This represented 25.9% of the total provincial licensees.

Steelhead have been caught from at least 85 streams in the Vancouver Island region in any given year (Steelhead Harvest Analyses 1966-67 through 1977-78), but over half of the estimated total annual steelhead catch is traditionally taken from five or six streams. The regional catch typically accounts for about 40% of all steelhead caught in the province.

QUESTIONNAIRE DESIGN AND CONTENT

The design of the questionnaire and its general presentation were patterned after previous surveys of hunters and anglers (e.g. Bjornn and Dalke 1975) which had high return rates indicating that recipients were satisfied with the format. Additional ideas were obtained from Bauer and Meissner (1963), Deming (1944), Erodo and Morgan (1970); Filion (1974); and Kanuk and Berenson (1975).

Questionnaire content resulted from a number of discussions and meetings between regional and headquarters staff of the Fisheries Branch and Dr. T.C. Bjornn of the University of Idaho.

The questionnaire was pre-tested by conducting streamside interviews with 25 Campbell River steelhead anglers in February 1977. On the basis of the interview clerk's recommendations, the questionnaire was modified slightly and a final draft prepared (Appendix A).

SAMPLE SELECTION MAILING AND DATA ANALYSIS

Questionnaire recipients were systematically selected from every second license sold to British Columbia residents on Vancouver Island between April 1, 1976 and March 31, 1977. The initial sample consisted of 3,068 steelhead anglers. Some residents of Vancouver Island may have purchased their license in

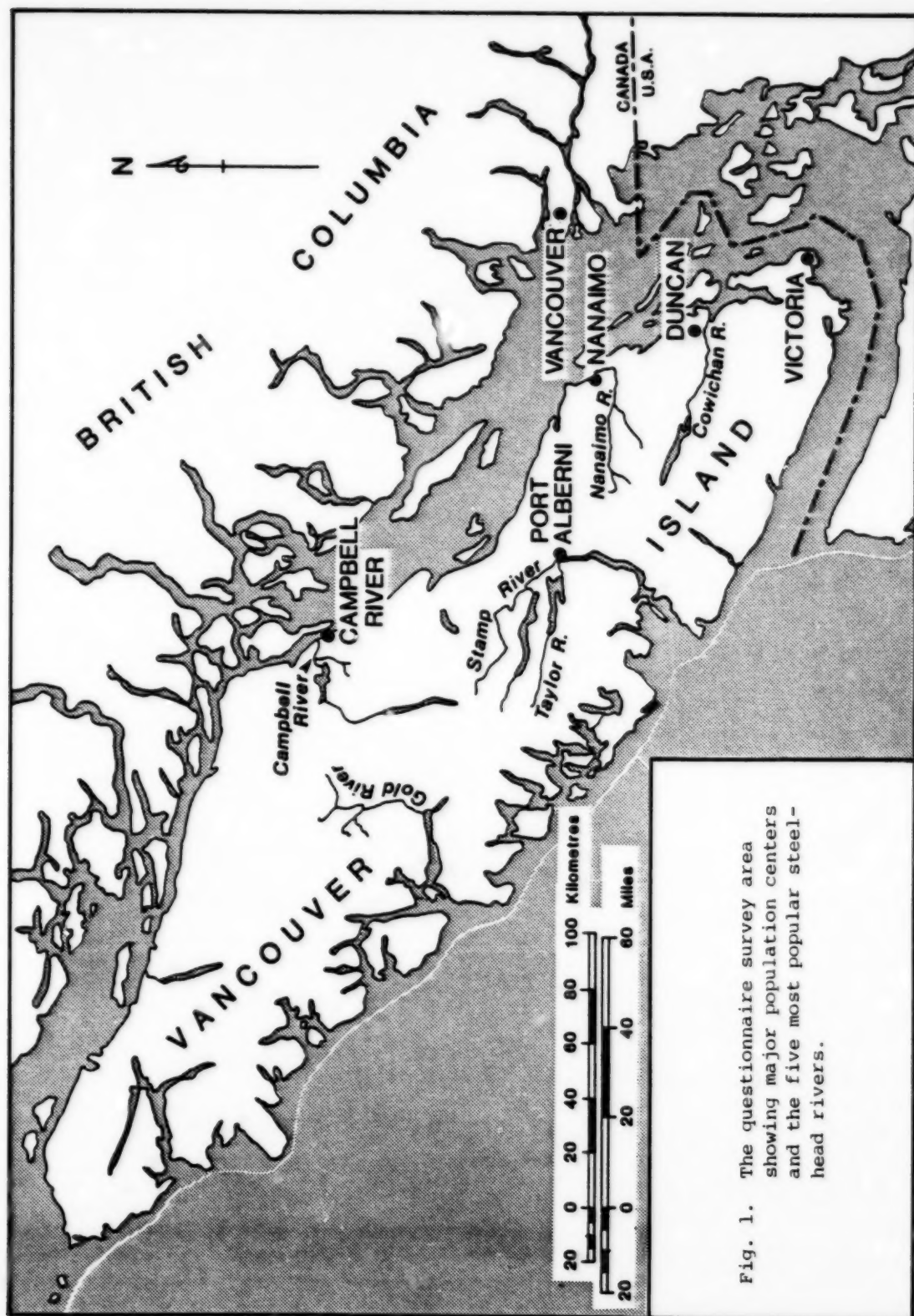


Fig. 1. The questionnaire survey area showing major population centers and the five most popular steelhead rivers.

another management region and thus were not included in the sampling. A few licenses (< 5%) were sold on Vancouver Island to non-Island residents but these were not removed from the sample.

The first questionnaire, with its covering letter, was mailed on July 8, 1977. After four weeks a second questionnaire with a covering letter and return envelope was prepared for each remaining set of address labels and mailed to non-respondents. Returns were again tabulated and the procedure repeated a third time three weeks later. Questionnaires (0.4%) returned after October 15 were not included in this analysis.

The Statistical Package for the Social Sciences (SPSS) (Nie, Bent and Hull 1970) was used to analyze the data.

RESULTS

The response from all mailings combined was 61.9% of the delivered questionnaires. The percentage response was 22.4, 14.5 and 33.7 percent for the first, second and third mailings, respectively. The combined response to all mailings was comparable to rates achieved in other multiple contact questionnaire surveys (Bjornn and Dalke 1975; Carpenter and Bowls 1976; Fillion 1976; McFadden *et al.* 1964). Eleven percent of all questionnaires mailed were returned as undeliverable by the post office.

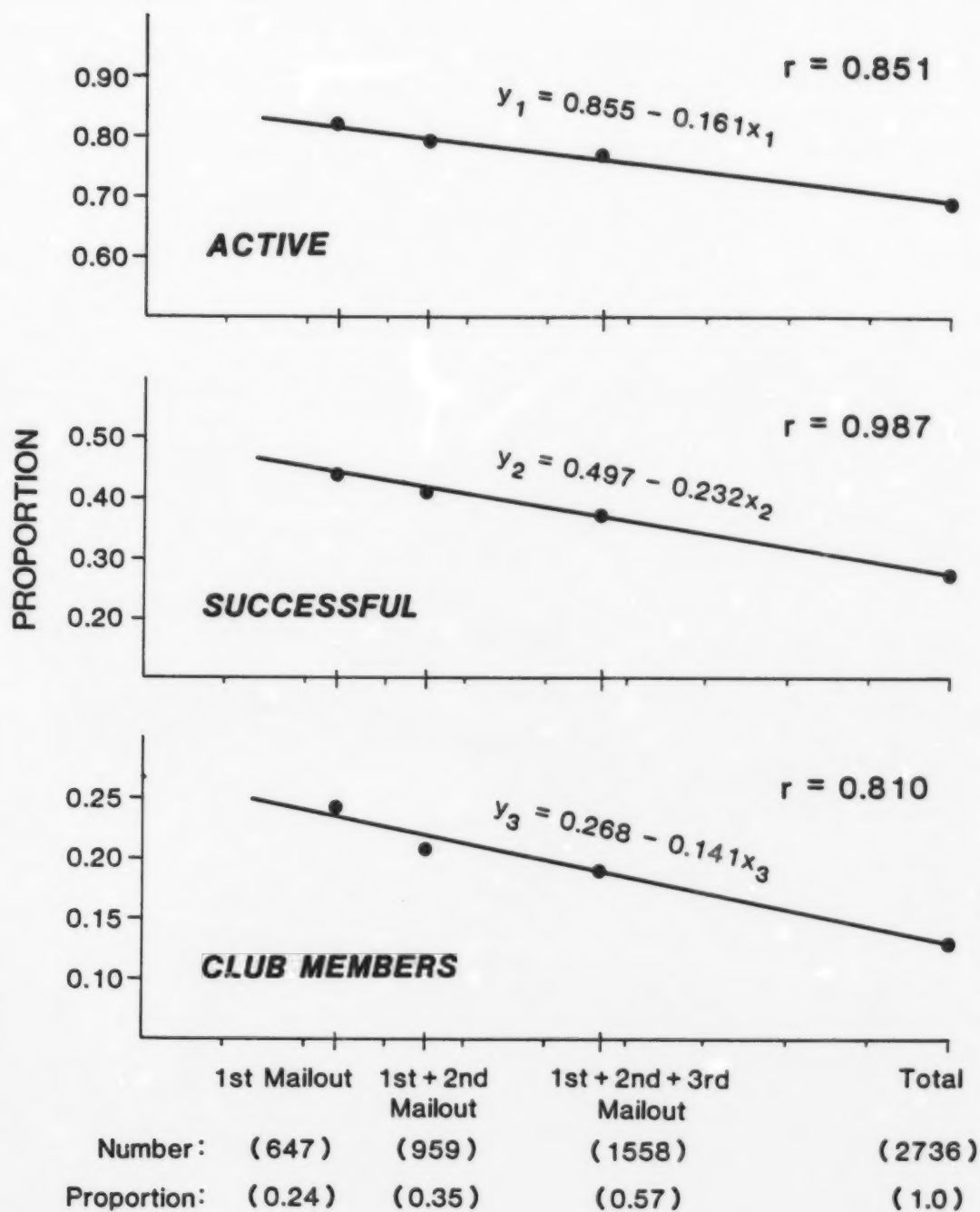
The response rate to individual questions varied considerably. Almost all respondents (approximately 95%) completed questions on their experience, catch, effort, and favorite angling streams. However, questions on steelheading substitutes, on management desires for information, and stream specific stocking preferences were answered by only 60-70% of those returning questionnaires. Management preference issues were addressed by 80-85% of all respondents.

RESPONSE BIAS

Non-respondents often differ markedly from respondents to mail surveys (Ellis 1970; Fillion 1976; Lehman 1963; Parten 1966). The strength and direction of bias is generally dependent on the number of follow ups and the ultimate response rate. Non-response bias can be corrected for by using a linear regression between the estimate of parameter values and the cumulated number of observations (Fillion 1974). Using this methodology response bias was detected in selected characteristics (Fig. 2). The differences between corrected and uncorrected values were statistically significant but were probably not significant from a management perspective, and I did not use corrected values except where specifically noted.

ANGLER EXPERIENCE AND DAYS FISHED

The average experience of active anglers (those that actually fished in 1976/77) was 8.8 years ($\pm .24$ SE). More than half of all respondents had less than five years' experience (Table 1). Respondents fished 14,458 days (84.3%) and 2,708 days (15.7%) for winter and summer steelhead, respectively. Anglers averaged 11.6 ($\pm .39$ SE) winter days but only 2.2 ($\pm .16$ SE) summer days. More than three-quarters did not pursue summer steelhead while one-quarter did not fish at all (Table 2). There was no significant correlation between years of steelheading experience and total days fished ($r = 0.12$).



QUESTIONNAIRE RESPONDENTS

Fig. 2. Linear regression estimates of the proportion of active anglers, successful anglers, and club members among all licensees who received a questionnaire done using the method of Fillion (1974).

Table 1. The number of years respondents had spent fishing for steelhead expressed as a percentage and a cumulative percentage of all respondents (n = 1,601 respondents).

<u>Years Fished</u>	<u>Percentage of Respondents</u>	<u>Cumulative Total Percentage of Respondents</u>
0	5.9	5.9
1- 5	48.3	54.2
6-10	19.9	74.1
11-20	16.0	90.1
>	9.9	100.0

Table 2. The number of days spent fishing for winter and summer steelhead in 1976-77 expressed as a percentage and a cumulative percentage of all respondents.

<u>Days Fished</u>	<u>Percentage of Respondents</u>		<u>Cumulative total Percentage of Respondents</u>	
	<u>Winter</u>	<u>Summer</u>	<u>Winter</u>	<u>Summer</u>
0	25.2	77.9	25.2	77.9
1- 5	32.6	13.8	57.8	91.7
6-10	17.3	4.1	75.1	95.8
11-20	14.9	3.2	90.0	99.0
> 20	10.0	1.0	100.0	100.0

CATCH

Among 1,240 active anglers reporting their catch success 35.6% caught and kept a steelhead and 33.0% caught and released fish (Table 3). Anglers kept 1,981 fish and released 3,017 for an average kill and release per angler of 1.62 (+ .10 SE) and 2.46 (+ .22 SE) steelhead, respectively. Sixty percent of the fish reportedly caught were released.

A small fraction of the angler population accounted for a large segment of the catch (Table 3). For example, 7% of anglers caught 66% of released fish (Table 3). A complete summary of mean catch, effort, and experience data is included in Appendix B.

Table 3. Breakdown for kept and released steelhead for the percentage and cumulative percentage of anglers in each catch category and the percentage and cumulative percentage of the total catch in each catch category. Only responses from active anglers (n = 1,240) are included in this table.

Number of Steelhead (Catch Category)	Percentage of Anglers		Cumulative Percentage of Anglers		Percentage of Total Catch		Cumulative Percentage of Total Catch	
	Kept	Released	Kept	Released	Kept	Released	Kept	Released
0	64.4	67.0	64.4	67.0	0	0	0	0
1- 5	28.1	21.7	92.5	88.7	39.5	20.6	39.5	20.6
6-10	4.0	4.4	96.5	93.1	25.8	13.2	65.3	33.8
11-20	2.7	4.4	99.2	97.5	21.8	25.2	87.1	59.0
> 20	0.8	2.5	100.0	100.0	12.9	41.0	100.0	100.0

Ten anglers (0.8% of total) reported catching and keeping more than 20 steelhead, although the annual catch limit in 1976/77 was 20. Either these individuals ignored the regulation or they misunderstood the question and recalled catches from the previous year when the allowable kill was 40. In either case, they accounted for nearly 13% of the total reported harvest.

Relationships between steelhead catch, fishing experience, and days fished were difficult to define because the catch per day was highly variable among anglers of similar experience and days fished. Regressions of fish released per day, fish killed per day, and total catch per day (i.e. killed and released) versus total days fished, log days fished, and years fished revealed no correlations (r^2 values from .001 to .031). Regressions of total days fished versus percent anglers catching fish in each experience class also produced low r^2 values (.003 to .241). Grouping both the days fished and the years fished data into classes and plotting these data against percent anglers catching fish gave a positive relationship (Fig. 3).

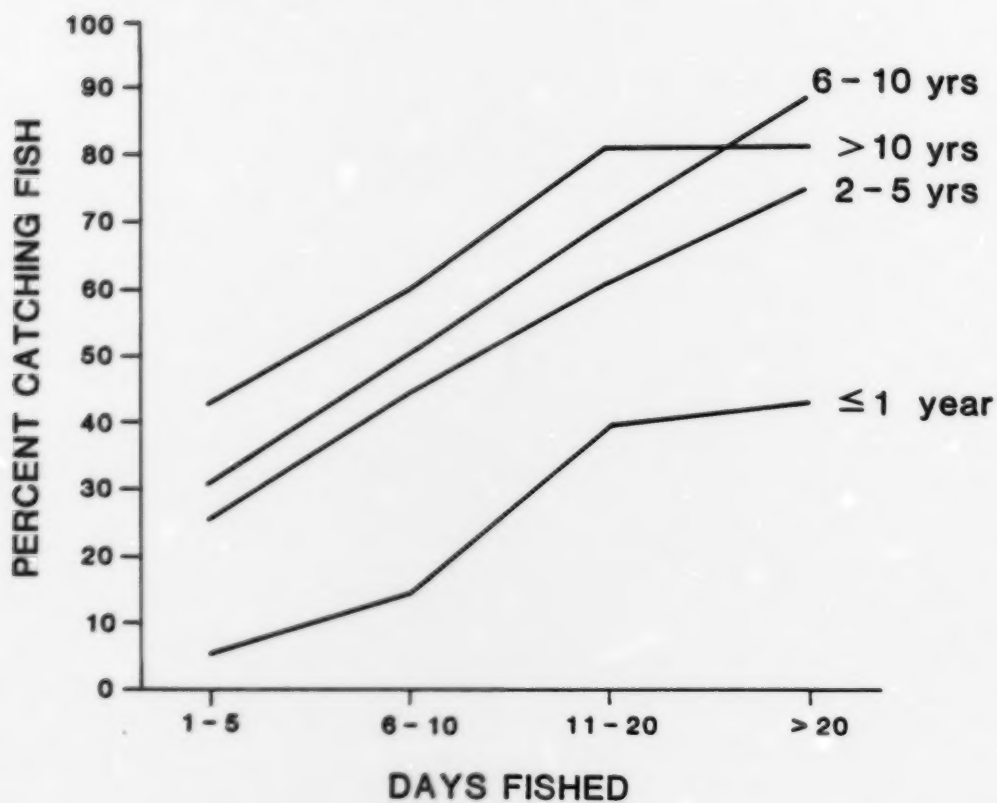


Fig. 3. Percentage of active anglers who had fished various numbers of years and days that had caught one or more steelhead.

Grouping of data was carried out in an attempt to reduce the large variances (i.e. data representing less than three anglers were pooled so that all points represented at least three anglers, and success and days fished were averaged at each point). Regressing percent anglers catching fish versus the log of days fished for each experience class then gave higher r^2 values (.226 to .639). Treating these data by analysis of covariance indicated that both total days fished and years of fishing experience had a significant effect ($P < .05$) on percent anglers catching fish. Using these transformed data and performing analysis of covariance between all experience classes, it was found that anglers who had fished two years or more were not significantly different (at the .05 level) from each other, but were significantly different (at the .05 level) from anglers in the ≤ 1 year class.

STREAM PREFERENCES

Anglers' favorite streams and the streams they fished most often were ranked by ascribing three points to a first choice, two to a second, one to a third, and then summing these values. In both cases the top ten streams accounted for more than half of the total score (Table 4). The percentage of the total score tallied for each of the top five streams closely paralleled annual questionnaire data of the Fisheries Branch on the proportion of the Vancouver Island steelhead catch and fishing effort in those same streams. Reasons most frequently given for favored stream choices were the proximity to the angler's residence (39.4%), the aesthetic quality of the surroundings (24.4%), the stream's reputation for good steelhead fishing (12.5%), lack of crowding (7.5%), past success (5.8%) and friends' advice (1.5%).

Table 4. The ten most preferred and heavily fished streams cited by questionnaire respondents ($n = 1,399$).

<u>Favorite Stream</u>	<u>Total Score (%)</u>	<u>Most Fished Stream</u>	<u>Total Score (%)</u>
Cowichan	14.5	Cowichan	16.0
Gold	7.2	Gold	7.8
Nanaimo	6.3	Nanaimo	6.8
Stamp	5.1	Stamp	5.9
Campbell	4.5	Campbell	4.8
Harris	3.5	Harris	3.1
San Juan	3.3	Quinsam	3.0
Little Qualicum	3.2	Englishman	2.8
Englishman	2.8	Sooke	2.7
Quinsam	2.7	Little Qualicum	2.7
Total	53.1	Total	55.6

RATING OF FISHING

The annual Steelhead Harvest Analysis indicated that the 1976/77 steelhead catch on Vancouver Island was low. Therefore, anglers were asked to rate the fishing in the more average 1975/76 season. This apparently did not strongly influence anglers' ratings since 56.4% of the respondents rated the fishing poor and almost 90% rated it no better than fair. Only 11.7% and .7% gave good and excellent ratings, respectively. Since a large majority of the steelhead were caught by few anglers and most anglers were unsuccessful, these ratings were not unexpected.

Anglers who caught more steelhead in 1976-77 tended to ascribe better ratings to the previous years' fishing than their less successful counterparts but anglers who had fished the longest rated the 1975-76 fishery lower than those who had recently started steelhead fishing. This was consistent with the overall downward trend in the Vancouver Island steelhead catch.

Among 123 anglers describing the 1975-76 fishery as good or excellent, 43 (35.0%) did not catch a steelhead in 1976-77. The fact that most (80.0%) of these anglers were relatively inexperienced may account for their higher than average ratings.

ATTITUDE TOWARD CROWDING

Licensees (n = 1452) asked about angler density on streams they commonly fished were divided in their opinions. Almost half (49.2%) stated that they would stop fishing those streams if the number of anglers increased by 50%. Seventy-three percent of the sample said they would quit if the angling pressure doubled. Crowding does not appear to be a serious problem at present since only 7.5% of anglers rated lack of crowding as an important characteristic of their favorite stream.

CLUB AFFILIATIONS

Anglers belonging to a steelhead club or society or to a fish and game association represented 256 (17.2%) of 1,490 respondents. Of these, 37 (2.5%) were members of the Steelhead Society of British Columbia. This group has traditionally been an aggressive and effective lobby in matters related to anadromous sport fisheries in British Columbia. At the time the questionnaire was circulated there were 78 members of the Steelhead Society resident on Vancouver Island. Since every second licensee was mailed a questionnaire, the response from this group was virtually complete.

Steelhead Society members average more days fished, more fish released, and higher total catch than either other club or non-club members (Table 5, Duncan's multiple range test, $P < .05$). For years of experience and steelhead kept, Steelhead Society anglers and those from other clubs were similar but different from non-club anglers. Seventy percent of the

Table 5. Means and standard deviations of years fished, days fished, steelhead kept, steelhead released, and total steelhead catch among active Steelhead Society members, members of other clubs, and anglers not associated with any fishing club.

<u>Parameters</u>		<u>Steelhead Society</u>	<u>Other Club</u>	<u>Non- Club</u>
Years fished	$\frac{n}{x}$	33	182	955
	$\bar{x}$	12.9	11.7	8.1
	SD	11.5	9.6	8.9
Days fished	$\frac{n}{x}$	33	185	965
	$\bar{x}$	33.8	17.3	12.6
	SD	31.9	20.9	16.5
Steelhead kept	$\frac{n}{x}$	33	182	949
	$\bar{x}$	3.6	2.5	1.4
	SD	3.7	4.6	3.2
Steelhead released	$\frac{n}{x}$	33	182	948
	$\bar{x}$	11.1	3.7	1.9
	SD	16.8	8.4	6.8
Total steel-head catch	$\frac{n}{x}$	33	182	944
	$\bar{x}$	14.7	6.1	3.3
	SD	18.5	12.1	8.9

Steelhead Society members pursued summer steelhead in contrast to only 35.6% and 32.4% of other club and non-club anglers, respectively. Every Steelhead Society affiliate who went fishing in 1976-77 caught at least one steelhead but less than half the active anglers in the other groups were successful.

PREFERENCES ON MANAGEMENT ISSUES

REGULATIONS

Licensees choosing between different options to reduce the kill of steelhead in streams with depleted stocks clearly preferred implementation of closures and gear restrictions versus angler permit systems or catch and release regulations (Table 6). The first choice was consistent between anglers of different fishing experience (Table 7). The chi-square test for independence of both regulations preference versus days fished and regulations preference versus total steelhead catch was significant ($P < .01$) (Table 7). There was a trend toward greater acceptance of catch and release as days fished and catch increased.

Table 6. Percentage of questionnaire respondents who stated a first (n = 1,430) and a second preference for steelhead regulations policies. First choice responses are also broken down by client group.

Broken down by client group:					
Regulation Policy	First Choice (%)				Second Choice (%)
	Client Group Breakdown of First Choice				Total
	Total	Steelhead Society	Other Club	Non- Club	
	n=1430	n=36	n=204	n=1131	n=815
Closures	52.9	38.3	57.4	52.0	23.5
Gear restrictions	21.2	17.6	19.6	21.2	41.0
Catch and release	13.5	35.3	12.2	13.4	15.7
Limit anglers	12.4	8.8	10.8	13.4	19.8

Table 7. Percentage of respondents of different years fished, days fished, and total steelhead catch classes who favored various steelhead regulations policies.

Parameter	Catch Class	Percentage Favoring			
		Closures	Gear Restrictions	Catch & Release	Limit Anglers
Years fished (n = 1,404)	< 1	55.9	17.5	11.8	14.7
	2- 5	51.3	22.1	13.3	13.3
	6-10	54.6	21.6	13.9	9.9
	> 10	52.4	21.6	13.9	12.1
Days fished (n = 1,376)	0	51.8	24.6	9.5	14.1
	1- 5	56.2	19.6	11.2	13.0
	6-10	51.8	22.3	10.6	15.3
	11-20	47.8	21.9	18.1	12.2
	> 20	54.3	18.1	20.5	7.1
Total steelhead catch (n = 1,364)	0	54.7	22.3	9.9	13.1
	1- 5	50.9	18.2	17.6	13.3
	6-10	43.7	25.0	24.0	7.3
	11-20	45.2	24.2	17.7	12.9
	> 20	56.1	15.1	22.7	6.1

Opinions of non-club and club (other than the Steelhead Society members) anglers regarding regulations did not differ significantly. Steelhead Society members differed significantly ($P < .05$) from members of other clubs in that they preferred greater emphasis on catch and release and less on closures (Table 6).

HATCHERY STEELHEAD

Vancouver Island in General

A majority of respondents (61%) expressed an opinion that hatcheries should be developed to maintain fishing opportunities. Only 5% felt no changes should be made and 34% favored more restrictive regulations to enhance wild stocks. Preference for the hatchery option increased slightly with experience ($P < .05$) but management choices were independent of fishing effort and catch ($P > .05$; Table 8). In contrast to other anglers, Steelhead Society members favored restrictive regulations instead of hatcheries as a management option (Table 9).

Table 8. Percentage of respondents of different years fished, days fished, and total steelhead catch class who chose various options to best describe how they wanted to see the Vancouver Island steelhead fishery managed.

		Percentage Favoring		
Parameter	Class	Wild Steelhead Existing Regulations	Wild Steelhead Restrictive Regulations	Hatchery Steelhead
Years fished (n = 1,319)	< 1	4.9	39.9	55.2
	2- 5	4.1	35.7	60.2
	6-10	2.5	37.1	60.4
	> 10	5.7	27.6	66.7
Days fished (n = 1,297)	0	5.3	35.5	59.2
	1- 5	5.0	30.2	64.8
	6-10	2.5	33.5	64.0
	11-20	3.2	36.1	60.7
	> 20	5.8	40.3	53.9
Total steel- head catch (n = 1,281)	0	3.9	35.2	60.9
	1- 5	4.9	29.8	65.3
	>6-10	<4.6	<40.7	<54.7
	11-20	3.4	32.2	64.4
	> 20	3.2	34.9	61.9

Table 9. Percentage of respondents of different client groups that chose various options to best describe how they wanted to see the Vancouver Island steelhead fishery managed.

Management Option	Steelhead Society (n=37)	Other Club (n=193)	Non- Club (n=1059)
Wild steelhead Existing regulations	2.7	4.1	4.2
Wild steelhead Restrictive regulations	56.8	29.5	34.6
Hatchery steelhead supplementation	40.5	66.4	61.2

Campbell/Quinsam System

A large majority (85%) of respondents (n = 1260) who provided their views on management of the Campbell/Quinsam steelhead fishery supported augmenting those stocks with hatchery fish. Less than 15% of the sample indicated that the Fisheries Branch should abandon its experiments on optimum methods of producing hatchery steelhead smolts. Less than 3% believed that present regulations should be left unchanged and the hatchery program abandoned.

Preferences toward management of the Campbell/Quinsam fishery were not related to experience, effort, and catch. In all classes of experience, effort and catch most respondents favored continuation of a hatchery steelhead program (Table 10). Most Steelhead Society members also favored the hatchery option, although the percentage within that group was not as large as for other clientele groups (Table 11) but there was a statistically significant difference ($P > .05$; chi square) between Steelhead Society members and other club members. There were no differences in management choices between respondents who listed versus didn't list Campbell/Quinsam as one of their favorite or most fished streams.

The existence of mutually exclusive combinations of options within those available for describing management preferences afforded an opportunity to assess the consistency of respondents' perceptions. The first and second options pertaining to the entire region provided for managing all streams for wild steelhead. The first option for Campbell/Quinsam involved proliferating hatchery steelhead in that specific system. Twenty-five percent of 1,176 respondents who gave their opinion on both the general and particular management situations chose the hatchery option in one situation but not the other.

Table 10. Percentage of respondents of different years fished, days fished, and total steelhead catch class who chose various options to best describe how they wanted to see the Campbell/Quinsam steelhead fishery managed.

Parameter	Class	Percentage Favoring		
		Supplement with Hatchery Existing Regulations	Abandon Hatchery Existing Regulations	Abandon Hatchery Restrictive Regulations
Years fished (n = 1,260)	< 1	85.3	3.0	11.7
	2- 5	84.1	2.0	13.9
	6-10	85.8	2.2	12.0
	<11-20	<84.6	<2.6	<12.8
	> 20	86.6	1.8	11.6
Days fished (n = 1,245)	0	84.5	2.6	12.9
	1- 5	87.1	1.5	11.4
	6-10	88.5	1.7	9.8
	11-20	81.3	4.6	14.1
	> 20	84.9	1.6	13.5
Total steel-head catch (n = 1,231)	0	86.0	2.2	11.8
	1- 5	86.2	3.0	10.8
	6-10	84.3	1.2	14.5
	<11-20	<71.2	<3.4	<25.4
	> 20	88.9	1.6	9.5

Table 11. Percentage of respondents of different client groups that chose various options to best describe how they wanted to see the Campbell/Quinsam steelhead fishery managed.

Management Option	Percentage Favoring		
	Steelhead Society (n=35)	Other Club (n=192)	Non-Club (n=1,013)
Supplement with hatchery Existing regulations	60.0	85.4	85.7
Abandon hatchery Existing regulations	2.9	1.6	2.1
Abandon hatchery Restrictive regulations	37.1	13.0	12.2

Stream Specific Stocking Preferences

When given an opportunity to choose whether any streams and, if so, which ones should be stocked with hatchery steelhead, a large majority (90%) replied yes. Of these, 70% did not specify particular streams. The preferences of the remainder were ranked by scoring five points for a first choice, four for a second, etc., and summing these products. The percentage of the points ascribed to the top ten streams accounted for more than half of the total available (Table 12). With four notable exceptions, these data were similar to those presented previously on "favorite" and "most fished" streams. Twenty-five percent of the respondents chose the same stream as their favorite, their most fished, and the one they most preferred for stocking.

Table 12. The ten streams most frequently chosen by respondents favoring introductions of hatchery steelhead (n=984).

<u>Stream</u>	<u>Percentage of Total Points Available</u>
Cowichan	14.0
Nanaimo	7.1
Campbell	5.2
Stamp	4.5
Puntledge	4.4
Oyster	4.3
Quinsam	4.0
Englishman	3.8
Big Qualicum	3.7
Sooke	3.6
Total	54.6

In contrast, Gold River which was the second most preferred and frequently fished stream, and Harris Creek which was sixth, ranked 16 and 15th respectively as stocking choices. Anglers apparently believed these streams had an adequate and stable supply of wild steelhead or did not want hatchery fish added to the streams. Puntledge River, which did not appear among the top 15 favorite and frequented streams, and Oyster River, which ranked last on those lists, placed fifth and sixth respectively as stocking choices. The ratings for those streams may reflect the historic status of those fisheries in the minds of anglers and the extent to which they have declined.

Again, reference to a number of mutually exclusive combinations of options revealed that respondents addressing the hatchery issue were not consistent in their choices. The most obvious example was that among persons stating a general

steelhead management preference and also a preference on which streams to stock, 271 of 1,097 (24.7%) chose an anti-hatchery option but also listed one or more streams to stock. In addition, 31 of 114 (27.2%) respondents stating that no streams should be stocked also stated that the hatchery program at Campbell/Quinsam should be continued. Lastly, 11 of 114 (9.5%) respondents who were against stocking any streams said they preferred the hatchery option as a general management approach. These data may have been related as much to question design and comprehension as to indecision or inconsistency on the part of survey participants and hence no attempt was made to exclude them from the analysis process.

COMMENTS BY RESPONDENTS

Comments included on the back of returned questionnaires and in numerous enclosed notes and letters were broadly classified under six headings: regulations and enforcement (38.9%), hatcheries (14.0%), habitat protection (12.5%), illegal net fishing by Indians (12.2%), commercial fishing (11.1%), and miscellaneous (unclassified) (11.3%). In total, 890 respondents voiced an opinion on one or more of the subjects. Comments were not cross-tabulated with other questionnaire variables.

The two most often repeated complaints related to enforcement and regulation. Anglers were concerned that they seldom or never encountered a Conservation Officer (afield or otherwise) and that allowing the use of roe was contributing to the steelhead's decline. No one commented in a positive way on either of these topics. Area specific and/or time specific fishery closure recommendations were numerous but too diverse to organize meaningfully. Other common recommendations dealt with banning treble hooks, improving on the steelhead punchcard license, and modifying license fee structures.

Not surprisingly, many respondents focused their remarks on hatchery steelhead. Of all comments on this issue, only 11% were negative. The theme conveyed was that "any steelhead is better than none".

Protection of steelhead habitat, commercial fishing, and non-permitted net fishing by Indians were mentioned with approximately equal frequency. Many anglers were disturbed by what they viewed as destruction of watersheds by logging companies. The interception of steelhead by commercial salmon fishing nets and river net fishing by native peoples were considered by some to be the most important factor in the demise of steelhead stocks.

DISCUSSION

Traditionally, the Fisheries Branch has relied on correspondence, feedback from field staff, and periodic contact with sportsmen's groups to judge the efficacy of its management programs. The dangers of listening only to special interest groups and those users voluntarily registering their views when alternative uses of publicly owned resources are being considered have often been identified (Deming 1944; Filion 1976; McFadden et al. 1964; Wales and Lane 1957). The present study confirmed these suspicions and demonstrated that vocal segments of the user population often held different opinions than the general angling public. Reliance on traditional avenues of public expression would therefore lead to a biased interpretation of client's preferences.

INFORMATION DISBURSEMENT

Among Vancouver Island steelheaders, organized anglers are, on average, more experienced, more active, more successful, more interested, and, likely because of all of these, better informed and more opinionated than unorganized anglers. Differences were even more pronounced when Steelhead Society clients were treated separately. The origins of such differences undoubtedly lie in the many and varied experiences, opportunities, and perceptions of steelheaders. Though perhaps alterable to some extent, these differences can be expected to continue.

Bjornn and Dalke (1975) has shown that questionnaire recipients who were presented objective background information on certain wildlife issues together with the management question often responded differently than those not so informed. Responses from the "supplemental information" group tended to resemble those of wildlife managers thus implying that, given equal access to information, users will often form similar opinions. The conclusion is then that a carefully administered information distribution program can be of considerable benefit in promoting common understanding and reducing differences of opinion between various resource users or between users and managers. Given the results of this questionnaire program and the recent management direction of the Fisheries Branch, there are two subjects for which the Branch bears an immediate responsibility to enact such a communication program; hatchery steelhead and catch and release.

Effective avenues of disseminating information to steelhead anglers are not numerous. Experience and the present investigation have shown that management staff cannot rely on a representative sample or a majority of anglers to approach them. If three questionnaire mailings elicited responses from only 62% of recipients, and half of those were indifferent toward seeking information on issues affecting their sport, then it is apparent that the Fisheries Branch must take the initiative.

Alker (1974) addressed this subject and suggested that information could be conveyed to clients by (1) distributing literature to license vendors who would, if necessary, sell it at handling costs, (2) including pertinent information in the regulations booklet, (3) night school courses taught by fishing club members, (4) conducting further questionnaire programs but structuring questions along informative lines, and (5) determining what sources anglers utilize most for their information and employing same. Considering that this study found that most anglers rely on fishing companions for information, that alignment with fishing clubs is minimal, that questionnaire responses are far from complete (and in some cases biased), and that the present regulations pamphlet is frequently criticized for being too lengthy and complex, it is suggested that pertinent information could be mailed to all licensees either independently or in concert with the annual steelhead harvest analysis sampling. Specialists in public education are available and should be consulted to maximize the effectiveness of this approach.

HATCHERY STEELHEAD

Probably no subject familiar to steelhead anglers has elicited more controversy than hatchery programs. In British Columbia, advocates have been influenced by daily newspaper columnists and by catch statistics from Washington and Oregon. Stated simply, the proponent's argument is that more is better. Opponents' attitudes appear to have their origin in the oft quoted writings and addresses of the late respected British Columbia author-angler and conservationist, Roderick Haig-Brown (e.g. Haig-Brown 1968). Circular arguments between opposing factions revolve around preconceived (few resident anglers have actually experienced fisheries supported by hatcheries) notions of fish size and fighting quality, migratory behaviour, angler ethics, genetic pollution, and production costs. The division of opinion is underscored by results of this study that 39% of all anglers polled did not favor the management option of hatchery fish.

Preliminary results from this questionnaire have now been used to plan and support supplemental stocking of smolts in several streams. Despite the persistent division in client opinions, the Fisheries Branch has not undertaken any serious program to acquaint anglers with the advantages and disadvantages of the hatchery option. The Branch's hatchery program cannot be expected to be well received by all clients. However, without a campaign to communicate plans and objectives to steelheaders in general, hatchery programs will be less understood and accepted.

CATCH AND RELEASE

Catch and release programs were usually rejected by all questionnaire respondents except Steelhead Society members.

Ideally, managers would accept these results and reduce or gradually eliminate this unpopular measure from their regulations repertoire. Many biologists, however, believe that the advantages of catch and release regulations outweigh the disadvantages (Barnhart and Roelofs 1977) and the Branch is committed to extensive use of catch and release with its policy that no stream will be closed to angling if an alternate measure will achieve the conservation objective while still maintaining fishing opportunity. Given this and the survey results the Branch should undertake immediately to thoroughly communicate and explain their position.

DIVERSITY OF ANGLING OPPORTUNITIES

Between and within clientele groupings there were ranges in opinions and preferences on almost every questionnaire item. Unorganized fishermen were less experienced, fished less, and caught less. They favored hatchery introductions presumably because they viewed this as a certain method of increasing their catch. In contrast, Steelhead Society members who presently experience good success largely rejected the hatchery option and recommended that strict regulation be used to sustain their opportunities. Some anglers were prepared to fish in crowded situations, but others were not. Some who indicated that the proximity of their favorite and most visited stream to their residence was the primary motive for their choice were apparently unwilling to seek out more remote and perhaps more prolific angling locations. Conversely, others who cited reasons such as lack of crowding, pristine surroundings, and catch success, implied that travel was not a constraint on their angling activity. Summer steelhead were actively pursued by some experienced and successful enthusiasts, while a large majority of anglers of lesser experience and catch success were disinterested. Finally, some anglers considered the fishing to be excellent while many more declared it to be poor.

The observed range in characteristics, behavior, and preferences is not unusual. A number of researchers, among them Dexter (1971), Hampton and Lackey (1975), Hendee et al. (1968), and Manning (1979), showed that different recreationists desired different forms of experience. The implication is that managers must provide a variety of steelheading opportunities consistent with the preferences of client groups, traditional fishing methods and patterns, and the biological and physical capabilities of preferred fishing streams. As McFadden (1969) noted, the value of a particular fishery varies with the individual and hence socially acceptable management must consist of reducing the variance about the value curve by providing a broad range of opportunities, each managed for a narrow range of values.

To a certain extent, the Fisheries Branch has been successful in providing an array of steelhead angling opportunities on Vancouver Island. The geographic nature of the

region and its abundance of streams have permitted considerable latitude in setting of regulations and hatchery production goals. Certain waters have been restricted to specific gear types (e.g. fly only, artificial lure only), catch and release regulations have been implemented, and some modest fish culture programs are underway. However, biological and institutional, rather than social criteria, have been the reasons for the decisions. Presently, there is little evidence to indicate that the distribution of angling opportunities reflects angler distribution and preferred traveling distances.

In this context it is recommended that steps be taken to review regulations governing the regional fisheries, their motives, the distribution of waters under major regulation types (e.g. fly only, no bait, catch and release, special rivers), and the distribution of hatchery and other enhancement programs. These should be assessed relative to licensee distribution. Consideration should be given to establishing management units, the boundaries falling along watershed boundaries within a day's outing from major population centers. Ideally, each unit would incorporate similar opportunities roughly in proportion to the stated preferences of user groups. Lastly, and most importantly, any decisions made in this regard should be communicated to the public through mechanisms described previously.

STEELHEAD HARVEST ESTIMATION

The Fisheries Branch presently estimates annual stream specific catches of steelhead by conducting a province-wide post card questionnaire survey shortly after the license year ends on March 31. Approximately half of all resident steelhead anglers are asked to provide data on which streams they fished, how many days were spent at each, and how many steelhead were kept or released. An average of 40-45% of the licensees contacted normally respond. For individual streams, days fished, fish kept, and fish released are estimated by applying the average effort and catch data of respondents to the population. Since active and successful anglers are known to respond at a higher rate than inactive and/or unsuccessful anglers, population estimates derived through such procedures are commonly biased upward (Atwood 1956; Burns and Brown 1975; Hicks and Calvin 1964; Simpson and Bjornn 1965).

Data gathered during this questionnaire clearly illustrate the overestimation potential implicit in a single mail out survey. For example, using data from only one mailing (i.e. Branch estimation procedure) indicated that 44% of all licensees caught at least one steelhead. This percentage, together with the reported kill per successful angler (3.3), and the angler population (6,136), gave a harvest estimate of 8,910. Using data from three mailings combined the reported percentage of successful anglers fell to 37% and the harvest to 7,490. Carrying the analysis a step further using the cumulative mail out regression procedure of Filion (1975) the estimate of

successful anglers was only 27% ($r = .99$) (Fig. 3) and the harvest 5,470, almost 40% lower than the Branch procedure would predict.

None of these estimates necessarily accurately reflects the regional steelhead kill in 1976-77. Memory bias associated with questionnaire mailing dates relative to fishing seasons and the previously noted observation that perceptions of the season duration (and therefore catch) appeared to differ between respondents emphasize that it is the difference in estimates, not their absolute value, that is of concern. In view of the steadily intensifying pressure on steelhead resources and the integral part that accurate catch estimates must play in management of the fishery, it is recommended that the Branch revise its effort and catch estimation procedures. It should be technically and fiscally feasible to include, for at least one year, two additional mailings for the present questionnaire to at least a subsample of non-respondents. Such a process would not jeopardize long term trend data, yet would identify the magnitude of the non-response bias.

STEELHEAD CATCH DISTRIBUTION

A common feature of most steelhead fisheries is that a small minority of anglers catch a large majority of the fish (Smith 1980; Washington State Game Department 1980). In this investigation 64% of all respondents caught nothing while 2% accounted for approximately 30% of the total kill and 41% of the total release. These data have been used to justify reduction of seasonal steelhead bag limits on Vancouver Island. Since catch data indicated declines in steelhead abundance in several major streams, lower bag limits were instituted to reduce the harvest by a substantial percentage and yet affect relatively few anglers. The measure was not effective in redistributing total catch however, because successful anglers could continue fishing on a catch and release basis after their season bag limit was taken.

Some managers and anglers maintain that steps should be taken to distribute the total steelhead catch over a larger proportion of the clientele. If a significant number of anglers believed that catching fish was an important part of their pursuit, it would be expected that catch per se would have been cited in questions dealing with anglers' favorite and most fished streams. In fact, responses oriented toward fish placed a distant third among those listed (Table 8). The literature also confirms that catching fish ranks low among motives for angling (Bryan 1974; Hampton and Lackey 1975; Moeller and Engelken 1972). Smith (1980) found that for Oregon steelhead anglers the importance of actually catching fish did not vary significantly for different levels of fishing success.

Conversely, it can be argued that enhancement programs designed to increase the available supply of catchable steelhead should not be for the benefit of a very small minority of skillful anglers, especially when all licensees pay equally to support those programs. Following this reasoning, it would be worthwhile for Fisheries Branch managers to experiment with regulations limiting the number of steelhead an angler could catch and release on a particular stream. Considering the number of streams and angling opportunity available in the region, this should not constrain an appreciable number of anglers. In fact, such a measure may be welcomed by the large majority of anglers (most of whom catch nothing) if the increased availability of steelhead improves their chances or their catch.

MANAGEMENT RECOMMENDATIONS

1. Management biologists should undertake a program to acquaint anglers with the scope and intent of its planned hatchery steelhead programs and its catch and release regulations. Mail contact with licensees was suggested as the best available approach.
2. Given the diversity of questionnaire respondent experiences and preferences, it is evident that socially acceptable management must consist of providing a broad range of opportunities, each managed for a narrow range of values. It is recommended that consideration be given to establishing management units, each of which would contain angling options roughly in proportion to the preferences of user groups.
3. In view of the results of this survey and the increasing importance of accurately assessing stream specific steelhead harvest, the magnitude of the nonresponse bias should be assessed using a regression analysis of results of a sample of repeated mailings.
4. It was clearly evident that a small fraction of the Vancouver Island steelhead fishermen accounted for most of the steelhead kept and/or released. It was suggested that each angler has equal chance of entry to this skillful and highly successful group and that attempts to redistribute catch may not be well received or necessary. Conversely, it was also recognized that steelhead enhancement programs paid for by all should not be solely for the benefit of a skillful minority. In this context, it was recommended that regulations designed to limit the number of steelhead an angler could release be incorporated on an experimental basis on at least one stream.

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below. Please indicate your first and second choices of the type of regulation you prefer.

☐	Allow catch-and-release fishing only.
☐	Limit the number of anglers allowed to fish at any one time on some heavily fished streams (permit system).
☐	Close a section of the stream for all or part of a season.
☐	Restrict the type of gear an angler may use (e.g., fly fishing only, no bait, etc.)

13. Which streams (if any) on Vancouver Island do you think should be stocked with hatchery steelhead? (Please list in order of preference – not more than 5).

- 1) 4)
2) 5)
3) 6) None

14. According to Fish and Wildlife Branch guidelines steelhead smolts have been produced at the Quinam River Salmon Hatchery for the past two years. The intent of this program is not to increase the number of steelhead in the Campbell/Quinam system, but to find the best method of producing hatchery steelhead. Nonetheless, over the next three years more fish will be available and catch rate will increase. If an increase in the number of anglers also occurs, the catch rate will not improve. Angling regulations will be left as at present (catch-and-keep). In the future, which of the following management alternatives do you most prefer? (check one)

- ☐ Supplement runs in the Campbell/Dunsmuir hatchery steelhead to increase the number of steelhead and retain present regulations (potential increase in angler numbers, stable catch rate).
- ☐ Abandon the hatchery program and leave regulations unchanged (slow increase in angler numbers, declining catch rate).
- ☐ Abandon the hatchery program and use restrictive regulations (catch-and-release shorter season, or declining catch rate).

15. Are you a member of a fishing club or society?

☐ No ☐ Yes

If yes, which one(s)?

16. What is your occupation?

Do you have any other comments that you feel would be helpful?

Address Label



**British Columbia
Ministry of Recreation and Conservation
Fish and Wildlife Branch
in co-operation with**

Department of Fisheries and Environment

Thank you for your co-operation.

No. 4

STEELHEAD ANGLER PREFERENCE QUESTIONNAIRE

Dear Steelheader:

This questionnaire is designed to aid the Fish and Wildlife Branch in developing steelhead management programs on Vancouver Island. It is an extension of interviews with steelheaders on the Campbell and Quinsam rivers during the 1975-76 winter season. Your views and opinions regarding fishing regulations and hatchery programs are extremely important if we are to improve steelhead fishing. Please take this opportunity to participate in decisions affecting the future of your sport.

Thank you.

Note: This questionnaire is additional to the province-wide annual steelhead punchcard questionnaire.

1. How many years have you fished for steelhead?

2. Did you fish for:

Winter steelhead last year? ☐ How many days?

Summer steelhead last year? ☐ How many days?

3. Of the number of steelhead you caught on Vancouver Island last year:

How many did you keep?

How many did you release?

4. What are your favorite steelhead streams? Why? (Please list not more than three; streams do not have to be confined to Vancouver Island).

1. Stream

Reason

2. Stream

Reason

3. Stream

Reason

5. Which streams on Vancouver Island did you fish the most during the 1976-77 steelhead licence year? (Please list the three streams most fished). Why?

1. Stream

Reason

2. Stream

Reason

3. Stream

Reason

6. How would you rate Vancouver Island steelhead fishing last year (1975-76)?

Excellent ☐

Good ☐

Fair ☐

Poor ☐

Did not fish ☐

7. Would you stop steelhead fishing on the streams that you fish the most if there were:

1) A 50% increase in anglers

Yes ☐ No ☐

2) Double the number of anglers (100% more)

Yes ☐ No ☐

8. If you answered "yes" to either part of Question 7, is there another activity that you would substitute for steelhead fishing?

Yes ☐ No ☐ If yes, what?

9. Of the sources listed below which ones provide you with useful information about steelhead management? (Please check)

Magazines ☐

Other anglers ☐

Newspapers ☐

Radio ☐

Club meetings ☐

Television ☐

Other (please list) ☐

None of these ☐

10. Is there other information about steelhead management that you would like to have?

Yes ☐ No ☐ If yes, what?

11. Steelhead have declined in most streams on Vancouver Island as a result of logging, water diversions, pollution, and commercial and sport fishing. Few streams are now capable of producing more wild steelhead and fishing success (catch rate) will not improve unless some action is taken. Stream protection will continue to be a major objective of the Fish and Wildlife Branch, but this alone will not increase steelhead populations.

Regulations can be used to reduce the kill of wild steelhead and maintain or perhaps increase catch rates. Catch-and-release angling is one example of this type of regulation. When fish cannot be kept, however, some people lose interest in fishing and the catch rate of the remaining anglers rises.

If anglers wish to continue catching and keeping steelhead at present success rates then the number of fish in some Vancouver Island streams must be increased. This can be achieved by supplementing wild steelhead stocks with hatchery fish.

On the basis of the above information, which of the following management alternatives do you most prefer? (Please check).

☐ Continue to manage all streams on Vancouver Island for wild steelhead and retain present regulations. A gradual increase in anglers fishing for the same or fewer steelhead will result in lower catch rates.

☐ Continue to manage all streams on Vancouver Island for wild fish, but use restrictive regulations (see Question 12) to protect steelhead and possibly improve catch rates.

☐ Supplement steelhead runs in some streams on Vancouver Island with hatchery steelhead but manage remainder for wild fish and leave regulations unchanged.

12. In some streams, especially those with summer steelhead, the number of fish killed must be reduced to preserve the run. Regulations which might be used to achieve this are outlined

Appendix B. Mean (x), range (r) and standard deviation (s) of variables given by the first, second and third mailouts.

Variable	Mail Out			
	First	Second	Third	All
Years experience	x 10.1 (n=521)	8.2 (n=250)	7.8 (n=421)	8.8 (n=1232)
	r 1-54	0-60	1-50	0-60
	s 10.1	9.0	8.7	9.4
Days fished (winter)	x 13.6 (n=528)	8.9 (n=251)	10.4 (n=428)	11.6 (n=1247)
	r 0-125	0-75	0-100	0-125
	s 17.3	9.8	13.5	14.9
Days fished (summer)	x 2.5 (n=528)	2.0 (n=251)	1.7 (n=428)	2.2 (n=1247)
	r 0-90	0-40	0-60	0-90
	s 7.4	4.9	5.0	6.1
Days fished (total)	x 16.2 (n=528)	10.9 (n=251)	12.2 (n=428)	13.8 (n=1247)
	r 1-150	1-105	1-100	1-150
	s 20.4	12.4	14.6	17.2
Fish kept	x 2.0 (n=517)	1.2 (n=247)	1.3 (n=423)	1.6 (n=1226)
	r 0-32	0-25	0-27	0-32
	s 4.1	3.1	3.1	3.6
Fish released	x 3.0 (n=516)	2.0 (n=246)	2.1 (n=424)	2.5 (n=1225)
	r 0-100	0-78	0-50	0-100
	s 9.0	7.2	6.2	7.7
Total fish caught	x 5.0 (n=515)	3.2 (n=245)	3.5 (n=422)	4.1 (n=1221)
	r 0-120	0-92	0-70	0-120
	s 11.5	9.6	8.6	10.1
Catch/day (kept)	x .119 (n=517)	.095 (n=247)	.100 (n=423)	.107 (n=1226)
	r 0-1.083	0-1.0	0-2.0	0-2.0
	s .205	.185	.224	.206
Catch/day (total)	x .250 (n=515)	.204 (n=245)	.230 (n=422)	.232 (n=1221)
	r 0-30	0-1.9	0-6.0	0-6.0
	s .399	.354	.488	.421

List of previous Fisheries Technical Circulars

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